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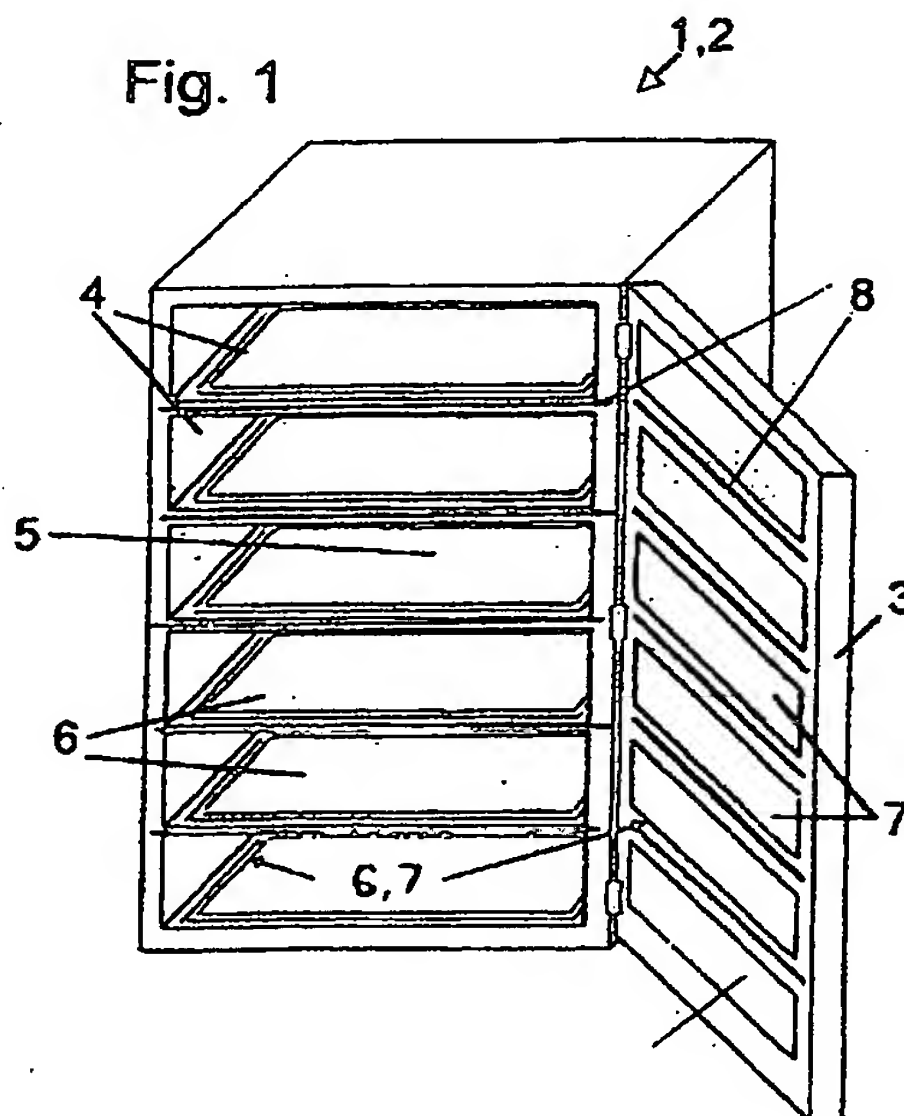
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(54) Abstract Title

**Storage means for storing articles relocatable by signalling**

(57) Storage means (2), for example a cooling appliance, comprises a storage space divided into a plurality of zones (5), at least one antenna (6, 7) for selective excitation of transponders mounted at stored articles, a plurality of receiver elements (6, 7) for reception of answer signals from selectively excited transponders, a control unit for controlling the antenna (6, 7) and identifying, by reference to the answer signals received by the receiver elements (6, 7), the zone (5) in which the selectively excited transponder is disposed, and a display device with a plurality of display elements each associated with a respective one of the zones (5) and each activatable by the control unit when the unit ascertains that a transponder delivering an answer signal is disposed in the associated zone (5). The transponder can have a light and/or sound source as transmitter element for the answer signal.



GB 2 371 722 A

Fig. 1

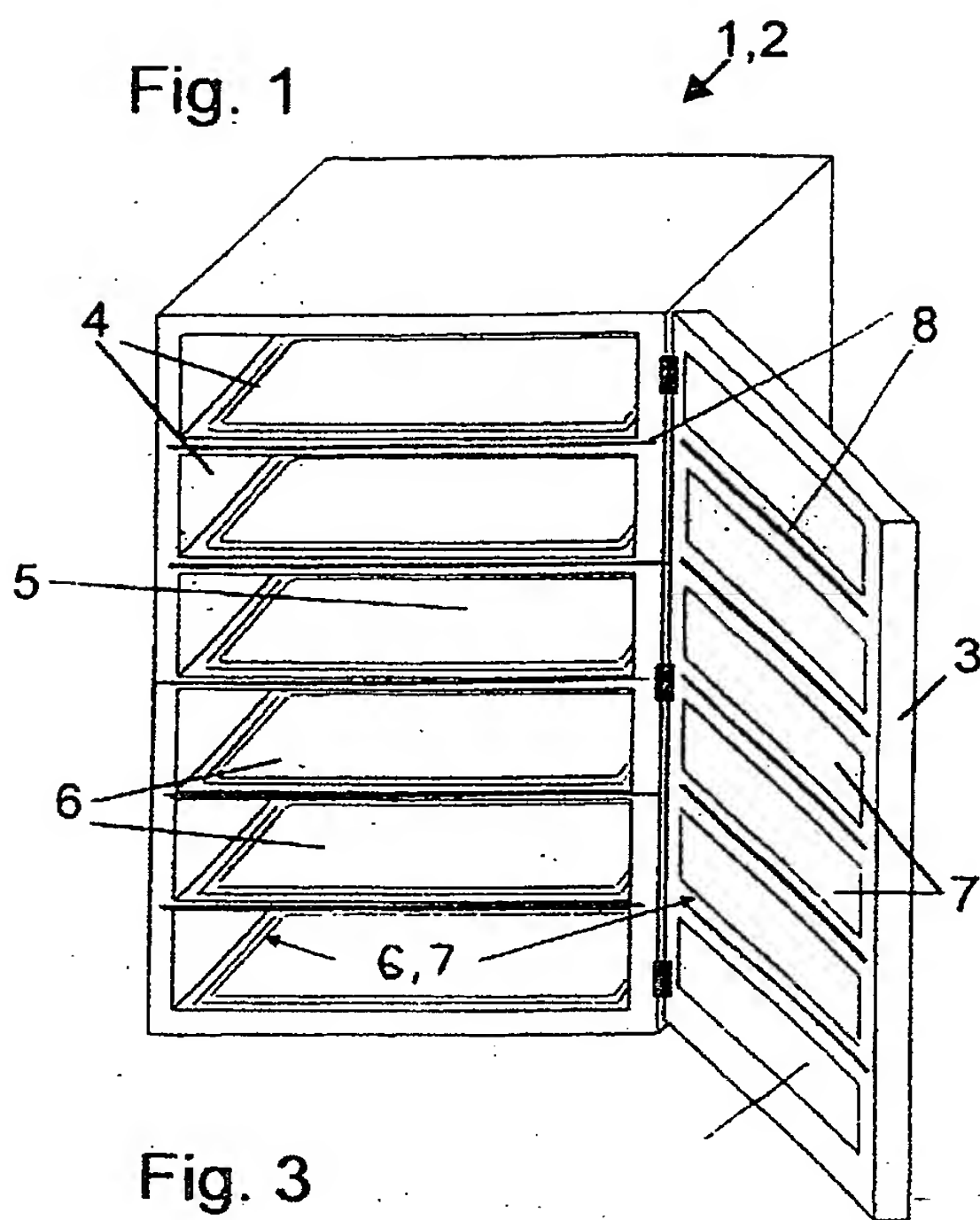


Fig. 2

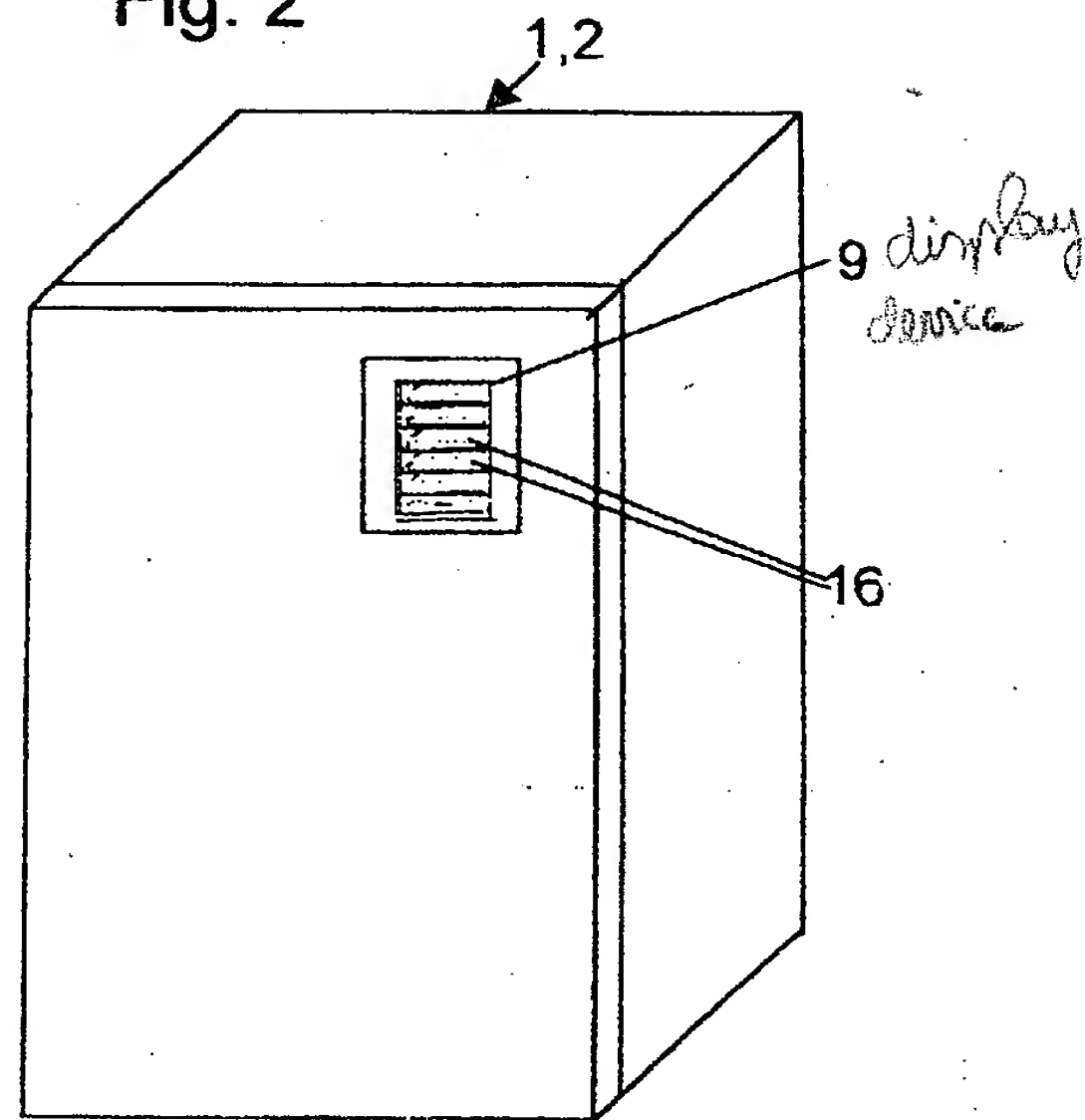


Fig. 3

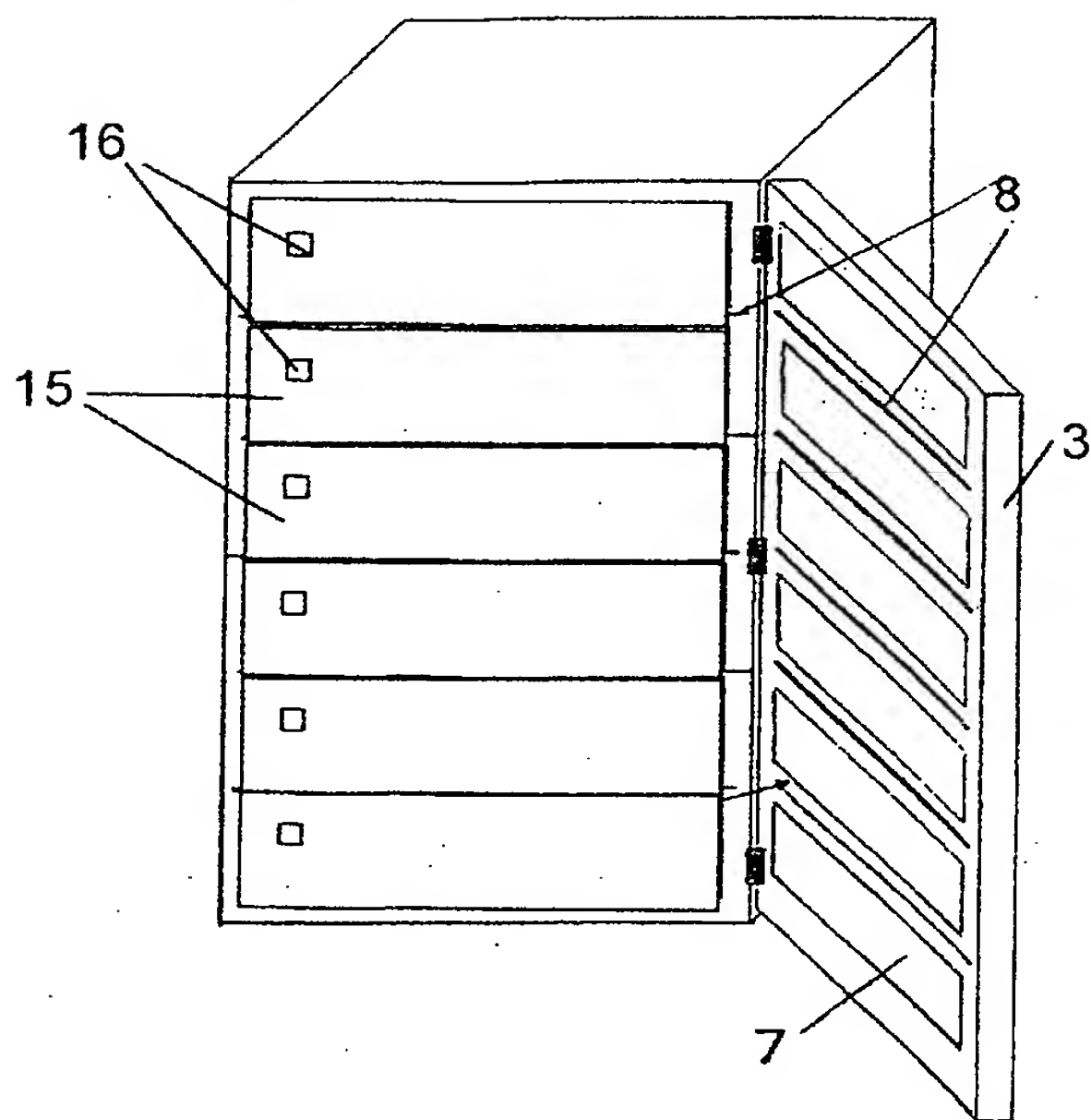
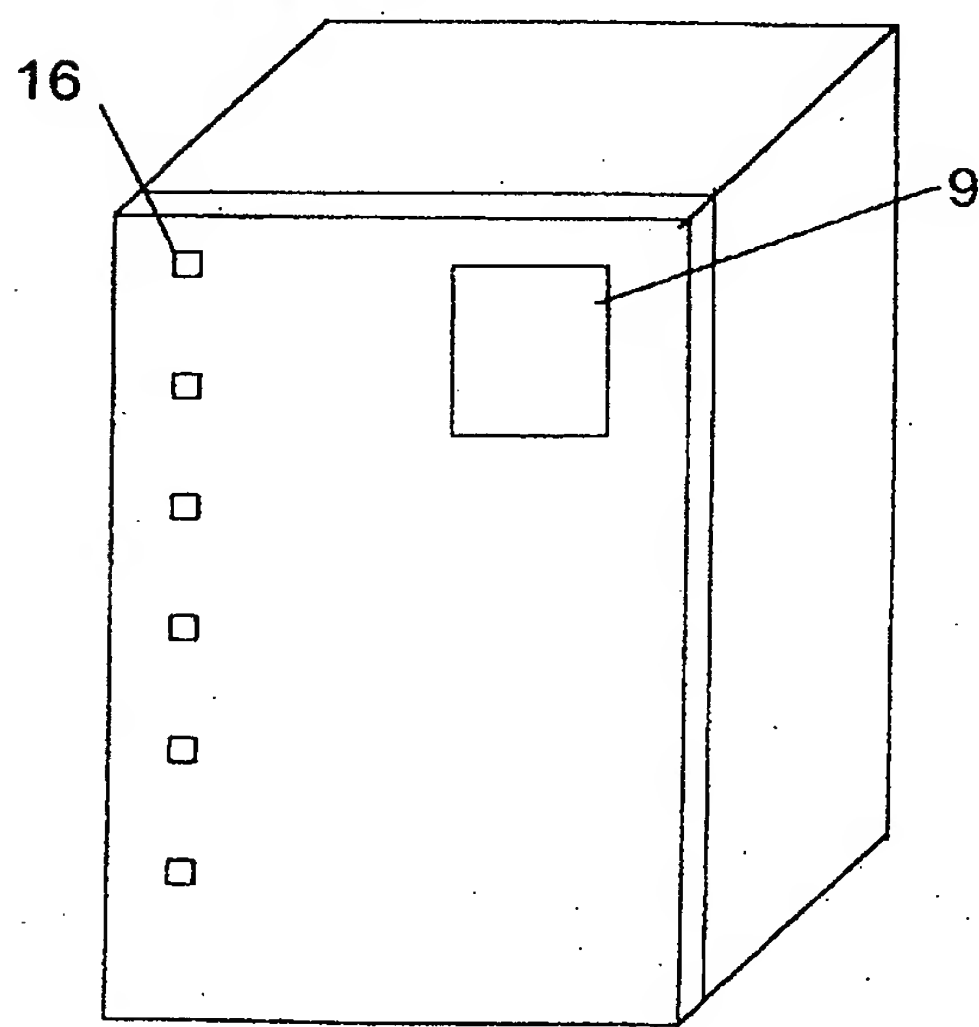


Fig. 4



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Fig. 5

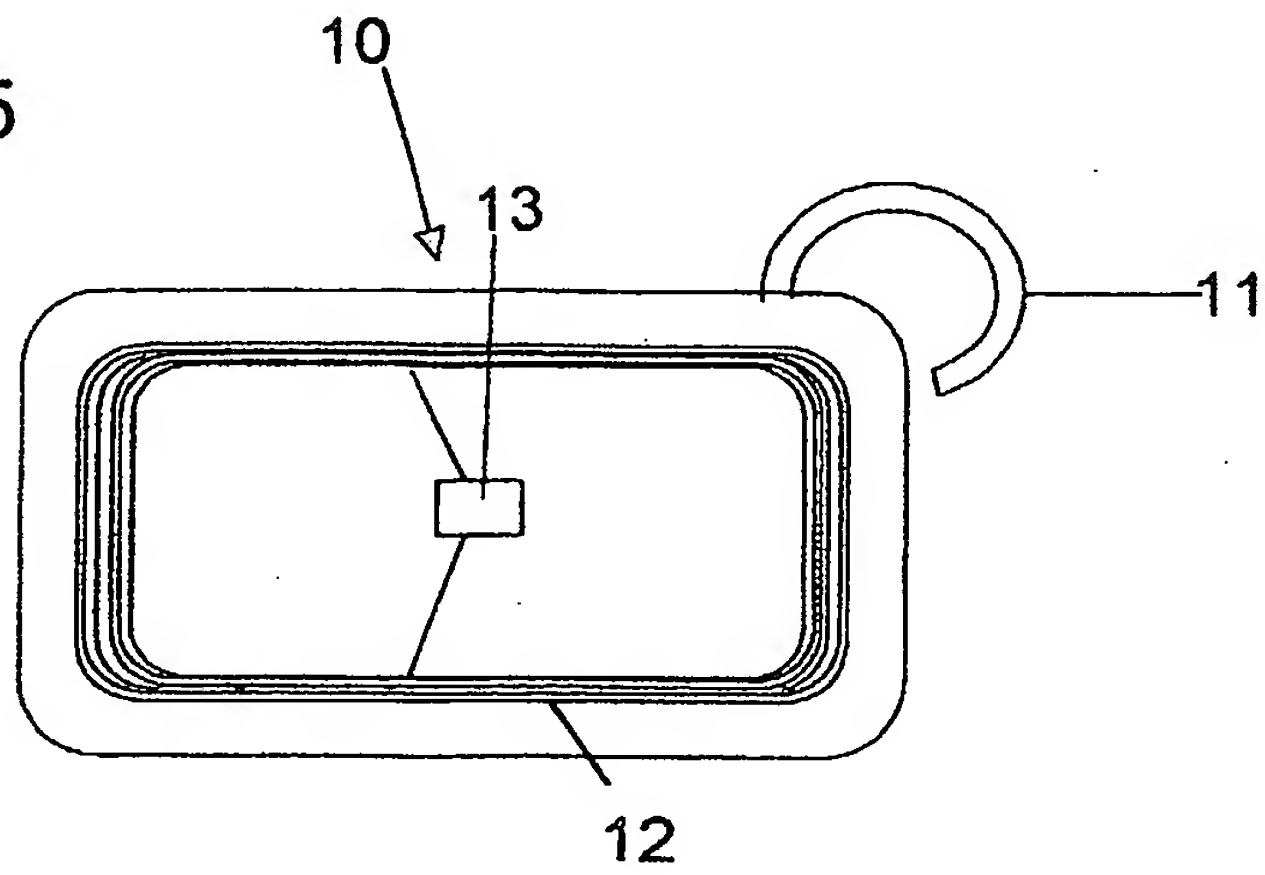
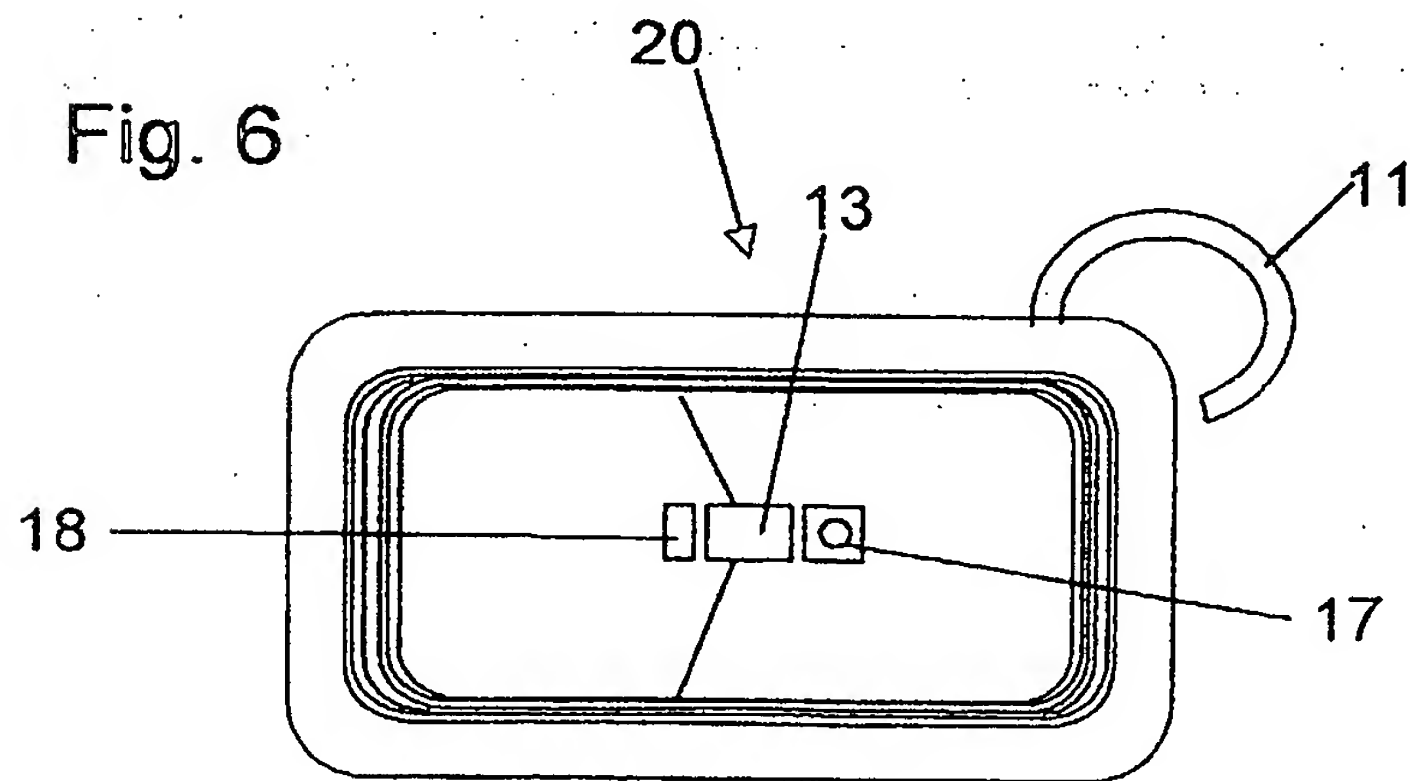


Fig. 6



STORAGE MEANS FOR STORING ARTICLES RELOCATABLE BY SIGNALLING

The present invention relates to storage means for storing articles, especially for storing articles at which transponders can be mounted in order to facilitate location of the articles.

There are various possibilities for achieving rediscovery of a stored article in such storage means. One possibility is to bring articles into a specific sequence on the basis of a recognisable external feature and to arrange the articles in the storage means in correspondence with this sequence, so that a user when searching for an article can establish, on the basis of the classifying feature of another article found beforehand, whether the sought article is to be found in front or behind thereof in the sequence. An example of that is the alphabetical classifying of books in shelves. Such a method presupposes that an identical feature is recognisable as a classifying criterion for all articles to be stored and is clearly determined. It is not suitable for storage and reliable rediscovery of heterogenous articles which cannot be rationally brought into an established sequence.

- There is also known the storage and rediscovery of articles in a shelving store with the aid of a computer-assisted data bank, in which the exact storage location is detected in each case when an article is stored and the location is called up from the data bank when the article is to be removed. However, such a method presupposes that a well-defined storage location can be allocated to an article to be stored and that the article remains at this location until it is to be removed again. The method is therefore not suitable for the rediscovery of stored articles in storage means in which for the removal of an article it can be necessary to temporarily remove or redispense a number of other articles.

A typical example for such storage means is a cooling appliance, especially a freezer chest or a refrigerator. The storage space of such an appliance is usually divided into zones or chambers, which are filled by the user from the viewpoint of a best-possible utilisation of space, but not ease of rediscovery of the stored articles. Stored articles are therefore frequently hard to find again and can be readily overlooked, with the consequence that shelf-lives may be exceeded or stocks repurchased only because still-existing items were not found when searching.

In order to avoid the risk of exceeding storage time and insufficient knowledge about the stored stock in a freezer appliance, it has been proposed in EP 0 974 798 A2 to equip a

freezer appliance with an antenna and/or a reader for detecting data at a data carrier which can be interrogated remotely and can be mounted at an article to be stored. A register of the stored articles and the positional location thereof is recorded at this known appliance and, through use of the antenna and/or reader, is kept to the current state by addition of data relating to newly stored articles and deletion of data relating to removed articles. The list can be called up with the assistance of control apparatus with an alpha-numeric display. In addition, the reader is to be able to deliver an optical and/or acoustical display about the storage place of a stored article, but it is left entirely open as to how this is to happen.

There is therefore a need for storage means in which there can be delivered to a user a directly learnable reference, which is not confined to speech or text, about the storage location of a sought article, as well as a need for a transponder which is especially intended for use with such storage means and which is in a position by itself and without the assistance of an external display device to facilitate the rediscovery of an article by a user.

According to a first aspect of the present invention there is provided storage means with a storage space divided into a plurality of zones and at least one antenna for selective excitation of transponders mounted at stored articles, with a plurality of receiver elements for reception of an answer signal of a selectively excited transponder and a control unit for controlling the antenna and for ascertaining the zone in which the selectively excited transponder is disposed by reference to the answer signals received by the receiver elements, characterised by a display device with a plurality of display elements, wherein a respective zone is associated with each of the display elements and is activatable by the control unit when the control unit ascertains that a transponder delivering an answer signal is disposed in the associated zone.

The storage means may be, for example, a cooling appliance. For preference, each zone corresponds with a compartment or drawer or a part of a drawer or compartment.

An association, which is rational for the user, of each display element with a zone can be achieved if, for example, the display device comprises a display table or surface on which the display elements are distributed separately with respect to location in an arrangement corresponding with the position of the zones relative to one another. Such a display table can comprise, for example, an image of the storage device with its individual zones, at



least one display element being disposed at the location of the image of each individual zone. In particular, the display table can be a screen display on which an image of the storage device can be generated and the display elements are regions, which correspond with the image of the zone, of the display screen.

In another embodiment the display elements are distributed at the storage means itself and arranged in each instance in an identical positional relationship to the respectively associated zone.

One form of association of a display element with a zone can result, particularly in the case of storage means such as a cooling appliance in which each zone is closed off by a front plate, from the display element associated with a zone being mounted at the front plate of that zone. This means that a user who has input a designation of a sought article into the control device of the storage means subsequently only has to search for the article in that zone or that compartment of the storage means at the front plate of which it is indicated, for example by flashing of a light source of the display element, that the sought article is disposed therein.

The receiver elements of the storage device can be antennae which are suitable for receiving radio answer signals from the transponders. A particularly simple embodiment of the storage means results therefrom, since the antennae can be used at the same time for the transmission of the excitation signals to the transponders.

In another preferred embodiment, the receiver elements are optical or acoustical detectors able to receive optical or acoustic answer signals from the transponders. This enables the use of a particular type of transponder as discussed in more detail further below.

Expediently, shields for the answer signals delivered by the transponders are arranged between the individual zones of the storage means so as to ensure, for example, that the answer signal of a transponder is received in each case by a receiver element of the zone in which the transponder is disposed with significantly higher intensity than by the receiver elements of adjacent zones. In order to be able to selectively address the transponders of stored articles it is advantageous if the control unit comprises a memory which contains information to be transmitted together with the excitation signal, in association with a designation of a stored article. This makes it possible for a user to input a designation of a sought article, whereupon the control unit ascertains, on the basis of the storage content,

the appropriate information to be transmitted and correspondingly modulates the excitation signal.

Moreover, it is advantageous if the control unit is equipped so as to be able to estimate the occupancy or load state of each zone and to activate the display elements in dependence on the estimated load state. An estimation of the load state of each zone is possible in simple manner in that the transponders disposed in the storage means are addressed sequentially and the control unit concludes, on the basis of the number of answer signals received in each zone, the approximate extent of occupancy thereof. Thus, a user who desires to store a new article in the storage means can with the aid of the display device identify a zone in which available space for the article is anticipated. The loading process is thereby accelerated and, in the case of a cooling appliance, cooling losses due to lengthy open times of a door or due to accessing several zones in the search for storage space are avoided.

According to a further aspect of the present invention there is provided a transponder with an antenna for reception of an excitation signal, a transmitter element and a control circuit for comparison of an item of information, which is transmitted together with the excitation signal, with a code and for transmitting an answer signal when the information matches the code, wherein the transmitter element is a light and/or sound source.

Such a transponder can fulfill a double function. In particular, it enables the ascertaining of a zone of the storage device in which a sought article is disposed without the user having to access individual zones for that purpose and look in. After the zone has been ascertained and the user has gained access, the user can himself or herself detect an answer signal delivered at that instant by the transponder, which considerably simplifies the search for an article in the zone. The transponder is suitable for use in storage means according to the first-mentioned aspect of the invention.

As operating energy source for operating the control circuit and the transmitter element the transponder can be equipped with an electrochemical cell such as, for example, a battery. Another possibility is that the transponder comprises an energy source chargeable by the excitation signal. Such an operating energy source can comprise, for example, an oscillator circuit which is tuned to a carrier frequency of the excitation signal and by which the carrier of the excitation signal is excited into oscillations.

Embodiments of the present invention will now be more particularly described by way of example with reference to the accompanying drawings, in which:

- Fig. 1 is a perspective view of first storage means, in the form of a freezer, embodying the invention;
- Fig. 2 is a view similar to Fig. 1, but showing the freezer with a closed door;
- Fig. 3 is a perspective view of second storage means, in the form of a freezer, embodying the invention;
- Fig. 4 is a perspective view of third storage means, in the form of a freezer, embodying the invention;
- Fig. 5 is a front view of a first form of transponder usable with storage means embodying the invention; and
- Fig. 6 is a front view of a second form of transponder usable with storage means embodying the invention.

Referring now to the drawings, there is shown in Fig. 1 a cooling appliance, more specifically a freezer 1, as an example of a storage device 2 embodying the invention. A door 3 of the freezer 1 is open and gives a view into the interior space, which is subdivided by bases 4 into a plurality of zones in the form of compartments 5. Each base 4 carries a respective antenna 6 in the form of a flat coil, further planar antennae 7 being arranged at the door 3 each in association with a respective one of the compartments 5. The antennae 6, 7 are connected with a control unit (not illustrated), from which they receive a high-frequency signal for transmission into the respectively associated compartments 5. In order to ensure that the antennae each transmit only into the associated and not an adjacent one of the compartments 5, a respective conductive plate or foil acting as a shield 8 is arranged in the base 4 and the door 3 below each of the antennae 6 and 7.

The control unit comprises a display device 9 for communication with a user, the screen being illustrated in Fig. 2 as a touch-sensitive screen mounted in the door 3. In an input mode of the system, the user can input a sought article into the control unit by, for example, selection of letters displayed on the screen or selection from a list of articles



displayed on the screen. The control unit thereupon ascertains in a memory a digital code word associated with the sought article and acts on all antennae 6, 7 with a high-frequency carrier signal modulated by the found code word.

This high-frequency excitation signal transmitted by the antennae is received by a plurality of transponders 10 (Figs. 5, 6) each fastened to a respective article stored in the freezer 1. Fig. 5 shows one example of a possible design of such a transponder. The transponder 10 has substantially the form of a small, flat synthetic material plate with a lateral, flexible ear 11, which is bent around and can be clipped to the edge of a freezer bag or suspended at the closure of a plastic bag. An antenna 12 in the form of a coil, which is connected with a logical integrated circuit 13, is printed on the transponder body. The coil and the logical integrated circuit 13 form an oscillator circuit having a resonance frequency corresponding with the carrier frequency of the excitation signal emitted by the antennae 6, 7. The oscillator circuit is thus excited by the excitation signal and thereby stores energy for a short period of time. The stored energy is sufficient for operation of the circuit 13, which extracts the coded information modulated at the excitation signal and compares it with a code stored in the circuit 13. If no agreement exists, nothing happens. If the circuit 13 establishes agreement, it utilises the energy stored in the oscillator circuit for transmission of an answer signal.

This answer signal is received with the highest intensity by the antenna 6 or 7 of that compartment 5 in which the transponder 10, or the sought article provided with this transponder, is disposed. Through a comparison of the intensities of the signals sent back by the antennae 6, 7 of the different compartments 5 the control unit can establish in which compartment 5 the sought article is disposed. In order to display the result to the user, the control unit displays on the screen 9, as shown in Fig. 2, a schematic illustration of the interior space of the freezer, in which those display elements or pixels of the screen which are associated with the compartment 5 in which the article was found are emphasised by a coloration, flashing, illumination or other such measure providing a distinction in relation to the other compartments.

These transponders 10 also play a role in the generation and actualisation of the above-mentioned list, which is to be displayed on the screen 9, of stored articles. One possibility for producing and up-dating this list is that a user inputs, on each occasion of storage of an article, a designation for the article, the designation thereupon being stored by the control unit in its memory in conjunction with a digital code word. In order to produce the link

between designation and code word, both can be input. Also conceivable, however, is an automatic reading of the code stored in the transponder when the article together with the transponder is loaded into the freezer. Instead of manual input of a designation, for example by way of the touch-sensitive screen 9, an automatic detection can be carried out, such as by reading a barcode, which is printed on the article, by an appropriate reader connected to the control unit.

In order, on removal of an article, to cancel from the list an entry corresponding with the article, a fresh detection of the barcode, or an input of a confirmation by the user that the article selected from the list has been removed, can be provided. It is also conceivable that after each access to the freezer, for example triggered by closing of the door 3, the control unit interrogates all transponders recorded in the list and automatically cancels from the list those entries for which no answer signal is received from the addressed transponder.

On the basis of the thus-received or not-received answer signals, not only a continuous inventorising of the content of the freezer is possible, but also the control unit can detect the number of articles in the compartments on the basis of the number of answer signals received for each individual compartment 5 and thus coarsely estimate the degree of occupancy of each compartment 5. On the basis of this estimate there can be displayed on the screen 9 to a user, who wishes to newly store articles, a compartment 5 in which space can be presumed to be available.

Figs. 3 and 4 show variants of the cooling appliance in which alternative display devices are provided for displaying to the user the compartment 5 in which an article has been found. Thus, for example, in the case of the freezer of Fig. 3 there is arranged in front of each compartment 5 a front plate 15 which protects the compartment and the content thereof against penetration of warmer air when the door 3 is opened. Such a front plate 15 can, for example, be folded down or pivoted in order to allow access to the compartment 5 disposed therebehind. It is also conceivable that the front plate 15 is part of a drawer insert which in each case receives the stored articles of a compartment and is pulled out together with the front plate 15 in order to give access to the articles. Each of the front plates 15 is equipped with a display element 16 in the form of a luminescent diode 16 which is temporarily switched on by the control unit when an answer signal to a transmitted excitation signal is received from a transponder in the relevant compartment 5.

In the case of the embodiment of Fig. 4, display elements 16 or luminescent diodes of the same type as in Fig. 3 are arranged at the door 3 of the freezer at heights corresponding with the respective compartments 5 which are disposed therebehind and with which they are associated. In this embodiment, a user can, as in the case of the embodiment of Figs. 1 and 2, ascertain the compartment in which a sought article is disposed before opening the door 3.

Obviously in the case of the embodiments of Figs. 3 and 4 the luminescent diodes 16 can be used in the same manner as the screen 9 of the embodiment of Fig. 1 and display to the user a compartment capable of receiving articles.

Various further modifications, which are not specifically illustrated in the drawings, of the storage device are possible. Thus, for example, it is not essential that the compartments each have two antennae 6, 7; a single antenna can be sufficient. In that case, however, it is desirable to use transponders with an antenna which has at least two coils with differently oriented axes in order to ensure that a coincidentally orthogonal orientation of the antenna of a compartment and the antenna of the transponder does not lead to the two being unable to communicate with one another. A further possibility is to arrange, instead of or in addition to the antennae 7, respective antennae at the side walls of a compartment 5.

It is also conceivable to arrange several antennae 6 in local distribution at the compartment bases 4, rather than just a single antenna 6. In this case the control unit can also estimate the position of the sought article within a compartment 4 by a comparison of the intensities of the answer signals received from the different antennae of a base 4. In such an arrangement, each display element advantageously consists of several luminescent diodes in a number corresponding with the number of antennae 6 and an arrangement corresponding with the arrangement of the antennae 6.

Moreover, it is not absolutely necessary that the answer signal delivered by the transponders is a radio signal; optical or acoustical signals are also appropriate. In this case, detectors for the optical or acoustical signals of the transponders must obviously be provided in each compartment 5 of the freezer 1 or, stated more generally, in each zone of the storage device, wherein, in particular, optical detectors must be present in sufficient number in order to be able to detect optical signals of the transponders independently of

where these are disposed in the associated zone and even when they are possibly at least partly covered by other stored articles.

Fig. 6 shows a transponder 20 suitable for use with such a storage device. It comprises, in addition to the components already illustrated and described with reference to Fig. 5, a luminescent diode 17 and a storage capacitor 18 for intermediate storage of electrical energy obtained with the aid of the oscillator circuit from the excitation signal and required for operation of the luminescent diode 17 and the logical integrated circuit 13.

The transponder can also be equipped with a battery, preferably a lithium round cell, as an energy source for operation of the circuit 13 and the diode 17.

The use of such a transponder 20 has the advantage that the optical answer signals delivered by the luminescent diode 17 are, by contrast to a radio answer signal, directly perceptible by a user. Thus, the user can, after the control unit has initially ascertained on the basis of the answer signal of the transponder 20 the zone of the storage device in which the sought article is disposed, quickly find the article in this zone with the assistance of the optical signal emitted by the luminescent diode 17. The same advantage can be achieved for a user with restricted visual capability by use of a transponder 20 equipped with, instead of or in addition to a light source such as the luminescent diode 17, a sound source, for example a piezoelectric buzzer, as transmitter for the answer signal.

In the case of the above-described transponder 20 it has been assumed that this produced a standard optical or acoustic answer signal not only for the detectors of the storage device, but also for detection by the user. Alternatively, it is possible to generate different answer signals, for example a radio signal for processing by the control unit of the storage device and an optical and/or acoustical signal for reception by a user.

In the extreme case, with use of transponder of that kind a detection and evaluation of the answer signal by the control unit can be dispensed with completely. It is sufficient if this produces the excitation signal which causes the transponder to deliver the acoustical or optical answer signal.

CLAIMS

1. Storage means for storing articles, comprising means defining a storage space divided into zones, transmitting and receiving means for transmitting excitation signals to selectively excite transponders at stored articles to emit answer signals and for receiving answer signals from excited transponders, control means for controlling the transmitters to transmit the excitation signals and for identifying, in dependence on received answer signals, the zones in which articles associated with excited transponders emitting the answer signals are located, and display means comprising a plurality of display elements each associated with a respective one of the zones and each activatable by the control means in response to identification of the associated zone as the location of an excited transponder.
2. Storage means as claimed in claim 1, wherein the storage means is a cooling appliance.
3. Storage means as claimed in claim 1 or claim 2, wherein each zone is represented by a compartment, drawer or a part of a drawer or compartment of the storage means.
4. Storage means as claimed in any one of the preceding claims, wherein the display means comprises a display surface and the display elements are distributed over the surface in a positional arrangement corresponding with the relative positions of the zones.
5. Storage means as claimed in any one of claims 1 to 3, wherein the display elements are distributed over the storage means to each be in the same positional relationship to the respectively associated one of the zones.
6. Storage means as claimed in any one of the preceding claims, wherein each display element comprises at least one light source.
7. Storage means as claimed in any one of the preceding claims, wherein each display element is disposed on a plate member closing off access to the respective zone.
8. Storage means as claimed in one of the preceding claims, wherein the transmitting and receiving means comprise at least one antenna for transmitting the excitation signals.



9. Storage means as claimed in claim 8, wherein the transmitting and receiving means comprise antennae for receiving the answer signals in radio form.
10. Storage means as claimed in any one of claims 1 to 8, wherein the transmitting and receiving means comprise optical or acoustical detectors for receiving the answer signals in optical or acoustical form.
11. Storage means as claimed in any one of the preceding claims, comprising screening means for screening the answer signals of each zone from those of the or each other zone.
12. Storage means as claimed in any one of the preceding claims, wherein the control means comprises a memory with stored data transmissible with the excitation signals in company with designations of stored articles.
13. Storage means as claimed in any one of the preceding claims, wherein the control means is operable to estimate the extent of occupancy of each zone by stored articles and to activate the display elements in dependence on the estimated extents of occupancy.
14. A transponder for use with storage means as claimed in claim 1, comprising an antenna for receiving an excitation signal, a transmitter element for transmitting an answer signal and control circuit means for comparing information transmitted with the excitation signal with a code and controlling the transmitter element to transmit an answer signal when the information matches the code, the transmitter element being at least one of a light and a sound source.
15. A transponder as claimed in claim 14, wherein the transponder comprises an electrochemical cell as an energy source.
16. A transponder as claimed in claim 14, wherein the transponder comprises an energy source chargeable by the excitation signal.
17. A transponder as claimed in claim 16, wherein the energy source comprises an oscillator circuit tuned to a carrier frequency of the excitation signal.



INVESTOR IN PEOPLE

Application No: GB 0128744.0  
Claims searched: 1 and 14

Examiner: Dr Jan Miasik  
Date of search: 22 May 2002

Patents Act 1977  
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.T): H4L(LAAA, LASS)

Int Cl (Ed.7): B65G1/137, F25D29/00, G01S13/75, H04B1/59, H04B7/14

Other: Online: EPODOC, JAPIO, WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X&	WO 00/33005 A1 (Bara et al.): see abstract	1-3, 8, 9, 12
&	US 20020023441 (Bara et al.): English language version	1-3, 8, 9, 12
X&	JP 2000296904 A (Fujitsu Ltd.): see abstract	1-3, 6-9, 12-13
&	US 6204763 B1 (Fujitsu Ltd): English language version, see whole document, particularly col. 5, line 48 - col. 7, line 32	1-3, 6-9, 12-13
X	US 5969606 (Motorola Inc.): see whole document	1, 2, 5-10, 12-13

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